APPENDIX B

Use of a Mixture of Beach Sand and Inspissated Oil
Dune Nourishment and Stabilization

THE BUREAU OF ECONOMIC GEOLOGY
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Observations made on South Padre Island in October 1979 revealed that much of the oil on the beach and at the toe of fore-island lanes had lost most of its volatiles and that the inspissated oil (that is, oil from which volatiles escaped) had been broken down into sandsize particles. At the time the observations were made the wind was strong and from the south-southeast; virtually none of the sand and associated sandsize hydrocarbons were being moved by the wind.

Inspissated hydrocarbons are not detrimental to the beach-dune environment since they are relatively inert. Sand-sized tar-like particles, if in sufficient quantity, serve as "sediment binders" or as a weak cementing agent. The Texas Highway Department has, in the past, sodded certain road cuts, and in order to stabilize the cover; the THD seeds and sprays the sod with an oilbase emulsion. Certain Arab nations are currently converting areas of migrating sand dunes into productive agricultural lands, first by stabilizing the dunes with crude oil, and secondly by seeding the dunes with various grasses, shrubs, and trees. It has thus been demonstrated that dunes can be stabilized by using hydrocarbons as a weak cementing agent, and that these hydrocarbons are not detrimental to subsequent vegetation growth.

As an example along the Texas barriers during the winter of 1974, fore-island dunes and an adjacent dune ridge were excavated to elevations near sea level to facilitate laying a pipeline across Mustang Island. After the pipeline was buried, the dunes and dune ridge were restored to their original contour. The barren sand was sprayed with an oil-based emulsion, sprigged with new vegetation, and covered with burlap to provide temporary stability. During the following spring, the restored dunes were colonized by certain types of vegetation such as sunflowers that typically occupy disturbed sand areas. In subsequent months, these primary flora gave way to natural dune vegetation. The revegetation process has proceeded to the extent that the area is essentially as it was prior to excavation.

Even trained observers with site-specific information have difficulty in detecting where the pipeline transects the dunes.

The south Texas barrier islands are in a semi-arid region where the prevailing southeast winds and hurricane storm surge inflict considerable erosional damage to the islands, particularly to the fore-island dunes. Since this is an area of low rainfall, vegetation on the fore-island dunes is sparse in many areas. Fore-island dunes werve to absorb much of the force impacted on the island by hurricanes. Fore-island dunes retard beach erosion during storms, and serve as a dam to hurricane storm surge flooding. Where fore-island dunes are low, or absent, storm damage may be severe.

In the past there have been some attempts to create and stabilize fore-island dunes to South Padre Island.[1] Picket fences were used to form a physical barrier to wind-transported sand, and native salt-tolerant grasses were then used to stablize these incipient dunes. Research on the stabilization of fore-island dunes has shown that bitter panicum and sea oats are the best plants for dune stabilization. It was also discovered that transplants of these grasses was much more successful than planting seed. The best time for transplanting sea oats is December through February and October through May for bitter panicum. Irrigation is required when vegetating barren dunes; also required is some sort of sediment binder, for example, burlap or an open-weave netting; in this case, inspissated hydrocarbons would serve as the sediment binder. Optimum spacing of transplants was approximately 70 cm; minimum dune height (in order to alleviate the adverse effect of hypersaline interstitial water) at which stabilization with grasses will be successful is about one meter.

The sand and hydrocarbons that are scraped off the beaches could be used advantageously to stablize existing fore-island dunes, and to initiate fore-island dunes in certain hurricane washover areas. It is recommended that these "experimental dunes" be not less than one meter in height, and that they be horizontally continuous for a few

[1]Dahl, B.E., Fall, B.A., Lohse, A., and Appan, S.G., 1974, Stabilization and Reconstruction of Texas Coastal Foredunes with Vegetation: Final Report to U.S. Army Corps of Engineers, Coastal Research Center, Fort Belvoir, V., Gulf Universities Research Corsortium, GURC Report, No. 139, 324 P.

hundred feet. They should consist of an appropriate mixture of oil or tar and sand. A picket fence should be erected immediately seaward of these experimental dunes as a protective measure against wind erosion. It is recommended that a general all-purpose fertilizer be applied at the time of seeding or transplanting. To further enhance rapid establishment of a vegetation cover, it is recommended that the experimental dunes be frequently irrigated. Utilization of the sand and hydrocarbons, removed from the beach during cleanup operations, to stabilize existing fore-island dunes and to initiate new fore-island dunes would not remove sand from the buffer zone, and therefore would not further deplete the sand budget; further depletion of the sand budget would aggravate shoreline erosion, which is high on certain stretches of the south Texas barriers. Information is available to define specific beach zones of erosion accretion, or equilibrium.

Advantages of using the sand and hydrocarbons for dune stabilization are several. First, the cost of transporting the sand and hydrocarbons to fore-island dune areas would be considerably less than hauling the materials to some back-island area. Secondly the sand budget would not be further depleted in an area that is already in an erosional state. Thirdly, the stabilization of existing fore-island dunes and/or establishment of new fore-island dunes would serve to enhance the natural stability of the vegetated coastal barrier dunes and provide further critical protection for hurrican storm surges.